Ian Tse

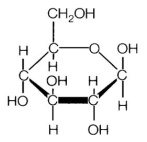
Food Chemistry

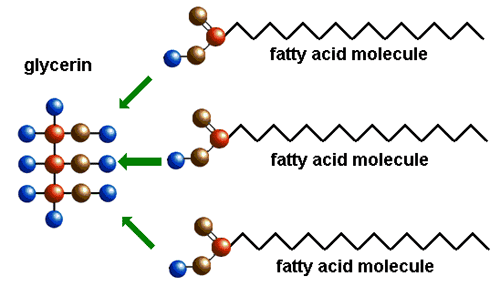
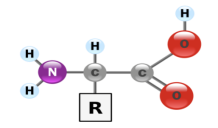
Food remains in high demand in everyday life, as a basic necessity. Many research and experiments are conducted to ensure that the foods delivered to retailers are the highest of quality. In order to accomplish this, food producers employ their knowledge of chemistry, including organic chemistry, collision theory and methods of increasing reaction rates.

**Organic Chemistry**

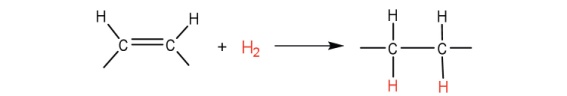
* Organic chemistry, in relation to food, is based on functional groups.
* Functional groups are specific groups of atoms that provide compounds with specific properties. These functional groups also dictate its shape and ability to react with other molecules.
* Compounds with the same functional group have similar properties.
* Carbonyl groups (C=O), include aldehydes( R-CHO)at the end of the carbon chain which produce strong pungent smells., and ketones (RCOR’), in the middle of the carbon chain, which sweet smells. Aldehydes include vanilla and cinnamon, and ketones include fruity smells.
* Carboxylic acid (R-COOH) groups cause compounds to have excellent hydrogen bonding but unpleasant smells.
* Hydroxyl groups contain the COH arrangement. This is a common functional group, especially in carbohydrates.
* Alcohol contains hydroxyl groups.

The structure of organic compounds in food can be divided into three main types: **Carbohydrates**, **Lipids** and **Proteins**.



* **Carbohydrates** include sugar, starch, cellulose (fibre), pectin, and gums.
* Simple sugars contain three to six carbon atoms as part of their carbon chain.
* Complex carbohydrates contain several saccharide units.
* **Lipids** have two components: glycerol and the fatty acid.
* Fatty acids contain 4-24 carbon atoms and have a carboxylic acid group.
* Glycerol contains 3 hydroxyl groups that can form ester bonds with a fatty acid.
* Saturated fats are linear – no double bonds and unsaturated fats can have more than one double bonded carbon.
* Saturated fats are solid(butter), and unsaturated fats are liquid(oil)
* **Proteins** are made of amino acids.
* A protein molecule consists of an amino group, carboxyl group, and an R group(any functional group)

**Catalysts and Enzymes**

* Catalysts and enzymes can be used to change one food form to another and speed up slow positive reactions.
* Liquid oils are treated with hydrogen and a nickel or palladium catalyst causing the hydrogen to break the double bonded carbons in the unsaturated fats.
* It takes it from the cis- form to the trans- formation.
* This makes the oil a solid – a process called hydrogenation which is used to make margarine.
* Enzymes can spoil food and cause enzymatic browning but also important functions such as yeast fermentation, cheese creation, and cocoa and coffee bean flavour development.
* Enzymes work on specific substrates due to lock and key model..
* In coffee production, producers locate and control the enzyme’s activity in producing sucrose, which when roasted creates the unmistakable aroma of coffee. NDP-glucose + D-fructose \rightleftharpoonsNDP + sucrose

**Food preservation**

* Collision theory, the number of reactant collisions, can help food producers limit certain reactions.
* One way is to develop suitable food packaging methods.
* Common preservatives such as nitrates, sorbates, sulphites and acetates can act in many ways.
* These preservatives react with the target reactants, such as oxygen, to prevent rancidity in foods.
* Obviously, it would be beneficial to obtain as many collisions as possible.
* Methods to accomplish this include food submersion in solution, dry powder, and vacuum seal.
* Depending on what food is being packaged, the method will differ.
* E.g. Taking advantage of potato chips’ large surface area and employing BHA and BHT powder, avoiding rancidity.
* E.g. Meats are injected with brine ( a salt solution) which denatures protein in the meat cells, thus retaining water.

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